

2N3303

NPN HIGH-SPEED, HIGH-CURRENT, SWITCH

SILICON PLANAR EPITAXIAL TRANSISTOR

The **2N3303** is a very high speed high current switch specifically designed for use as a thin film memory driver. The special characteristics of this device that make it uniquely optimum for this application are a 450 mc minimum f_T and a maximum V_{CE} (sat) of 0.7 V at 1.0 A.

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature

Operating Junction Temperature

Lead Temperature (Soldering, 60 sec. time limit)

-65°C to +200°C

200°C Maximum

300°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature

[Notes 2 and 3]

3.0 Watts

at 25°C Ambient Temperature

[Notes 2 and 3]

0.6 Watt

Maximum Voltages and Current

 V_{CBO} Collector to Base Voltage

25 Volts

 V_{CEO} Collector to Emitter Voltage [Note 4]

12 Volts

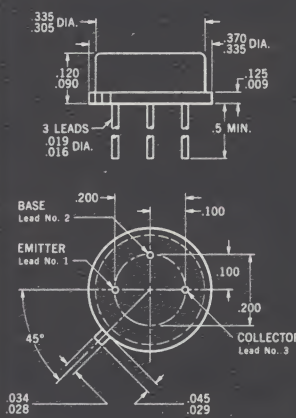
 V_{EBO} Emitter to Base Voltage

4.0 Volts

 I_C Collector Current

1.0 Amp

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
Lead 3 internally connected to case

ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
t_{on}	Turn On Time [Note 6]		10	15	nsec	$I_C \approx 1000$ mA $I_{B1} \approx 100$ mA
t_{off}	Turn Off Time [Note 6]		15	25	nsec	$I_C \approx 1000$ mA $I_{B1} \approx 100$ mA $I_{B2} \approx -100$ mA
τ_s	Charge Storage Time [Note 6]			15	nsec	$I_C \approx 100$ mA $I_{B1} \approx 100$ mA $I_{B2} \approx -100$ mA
h_{fe}	High Frequency Current Gain ($f = 100$ mc)	4.5	6.5			$I_C = 100$ mA $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Collector Saturation Voltage		0.18	0.23	Volts	$I_C = 100$ mA $I_B = 10$ mA
$V_{CE(sat)}$	Collector Saturation Voltage		0.24	0.33	Volts	$I_C = 300$ mA $I_B = 30$ mA
$V_{CE(sat)}$	Collector Saturation Voltage		0.51	0.7	Volts	$I_C = 1000$ mA $I_B = 100$ mA
h_{FE}	DC Pulse Current Gain [Note 5]	30	60	120		$I_C = 300$ mA $V_{CE} = 0.5$ V
h_{FE}	DC Pulse Current Gain [Note 5]	30	50			$I_C = 100$ mA $V_{CE} = 0.5$ V
h_{FE}	DC Pulse Current Gain [Note 5]	20	45			$I_C = 10$ mA $V_{CE} = 0.5$ V

Copyright 1964 by Fairchild Semiconductor, a Division of Fairchild Camera and Instrument Corporation

NOTES:

- (1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
- (2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
- (3) These ratings give a maximum junction temperature of 200°C and junction-to-case thermal resistance of 58.3°C/watt (derating factor of 17.2 mW/°C); junction-to-ambient thermal resistance of 291.6°C/watt (derating factor of 3.43 mW/°C).
- (4) This rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4.
- (5) Pulse Conditions: length = 300 μ sec; duty cycle = 1%.
- (6) See switching circuit for exact values of I_C , I_{B1} , I_{B2} .

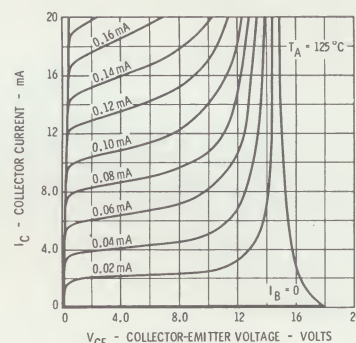
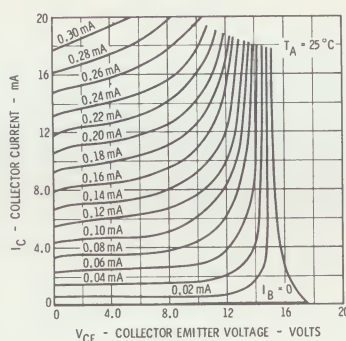
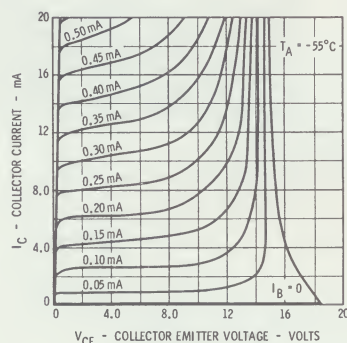
FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

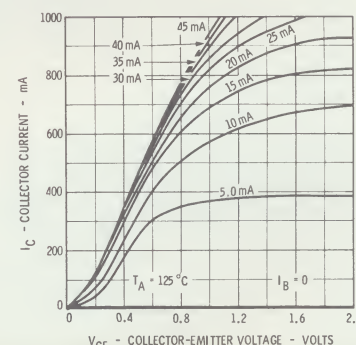
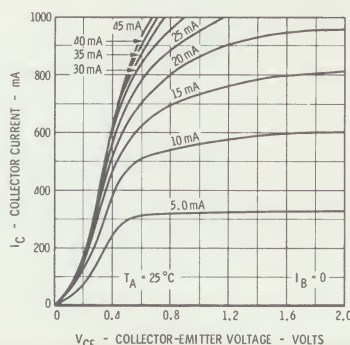
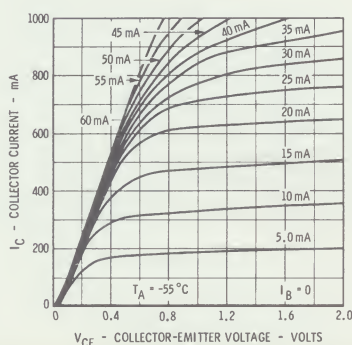
SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
h_{FE} (-55°C)	DC Pulse Current Gain [Note 5]	10	33			$I_C = 300 \text{ mA}$ $V_{CE} = 0.5 \text{ V}$
$V_{BE}(\text{sat})$	Base Saturation Voltage	0.72	0.78		Volts	$I_C = 10 \text{ mA}$ $I_B = 1.0 \text{ mA}$
$V_{BE}(\text{sat})$	Base Saturation Voltage	0.85	1.1		Volts	$I_C = 100 \text{ mA}$ $I_B = 10 \text{ mA}$
$V_{BE}(\text{sat})$	Base Saturation Voltage	1.1	1.3		Volts	$I_C = 300 \text{ mA}$ $I_B = 30 \text{ mA}$
$V_{BE}(\text{sat})$	Base Saturation Voltage	1.4	2.1		Volts	$I_C = 1000 \text{ mA}$ $I_B = 100 \text{ mA}$
$V_{CE}(\text{sat})$	Collector Saturation Voltage	0.17	0.25		Volts	$I_C = 10 \text{ mA}$ $I_B = 1.0 \text{ mA}$
$V_{CE}(\text{sat})(+125^\circ\text{C})$	Collector Saturation Voltage	0.3	0.5		Volts	$I_C = 300 \text{ mA}$ $I_B = 30 \text{ mA}$
I_{CES}	Collector Reverse Current			100	μA	$V_{CE} = 10 \text{ V}$ $V_{EB} = 0$
C_{TE}	Emitter Transition Capacitance		15	25	pf	$V_{EB} = 0.5 \text{ V}$ $I_C = 0$
C_{ob}	Output Capacitance		6.0	15	pf	$V_{CB} = 5.0 \text{ V}$ $I_E = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	25			Volts	$I_C = 0.5 \text{ mA}$ $I_E = 0$
$V_{CEO}(\text{sust})$	Collector to Emitter Sustaining Voltage [Notes 4 and 5]	12			Volts	$I_C = 30 \text{ mA}$ $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0			Volts	$I_E = 0.1 \text{ mA}$ $I_C = 0$

TYPICAL COLLECTOR CHARACTERISTICS*

ACTIVE REGION



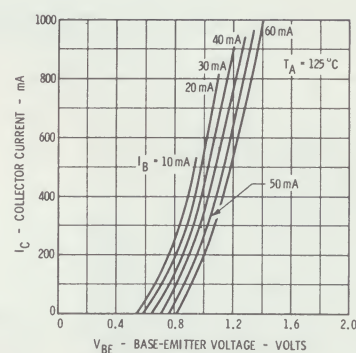
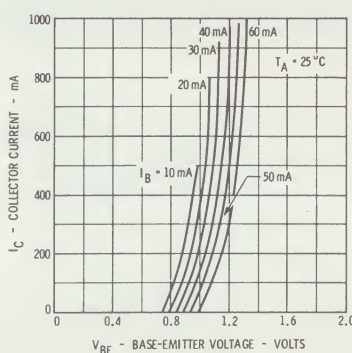
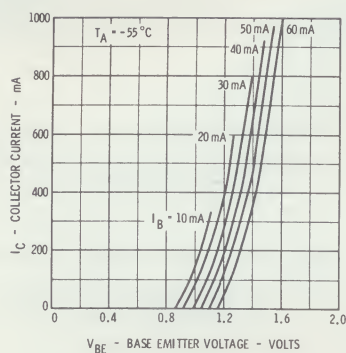
SATURATION REGION



* Single family characteristics on Transistor Curve Tracer.

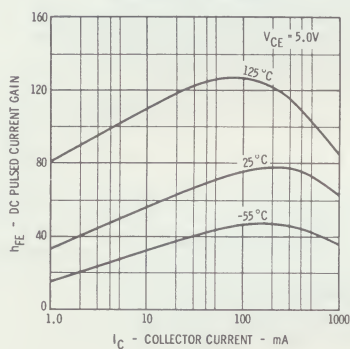
TYPICAL BASE CHARACTERISTICS*

SATURATION REGION

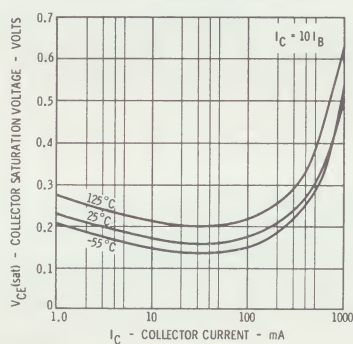


TYPICAL ELECTRICAL CHARACTERISTICS

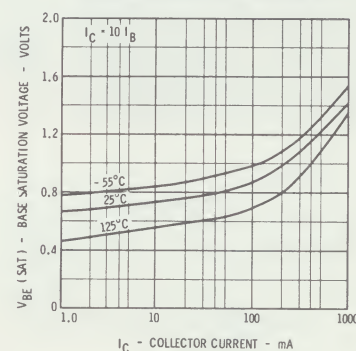
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



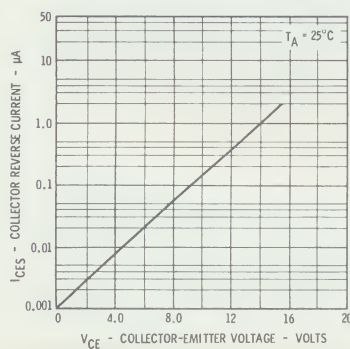
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



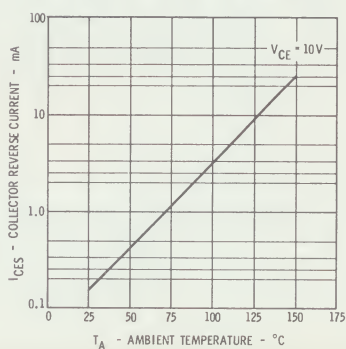
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



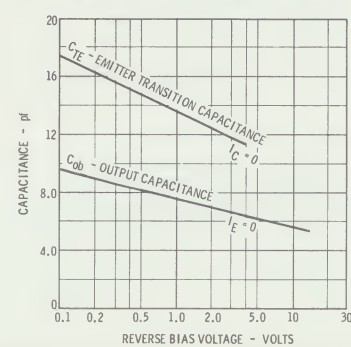
COLLECTOR REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



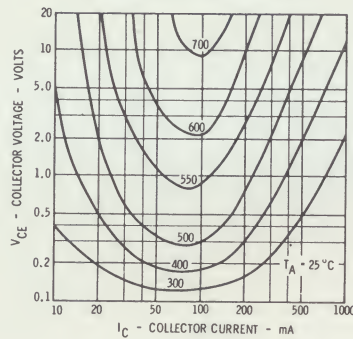
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



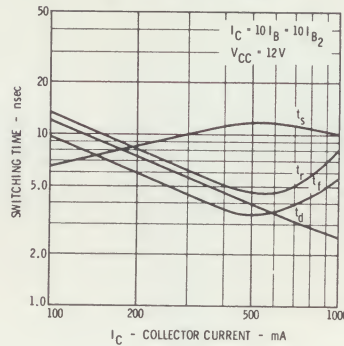
* Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

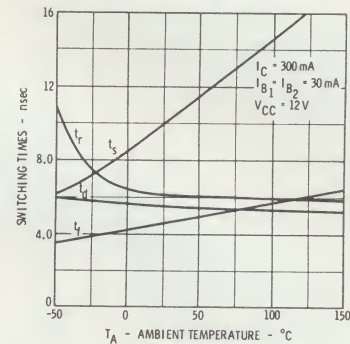
CONTOURS OF CONSTANT GAIN
BANDWIDTH PRODUCT (f_T)



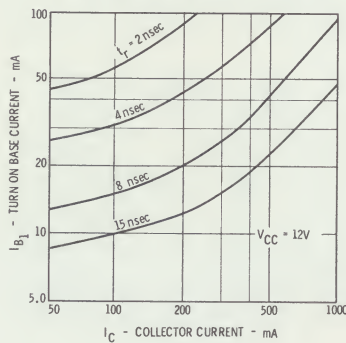
SWITCHING TIMES VERSUS
COLLECTOR CURRENT



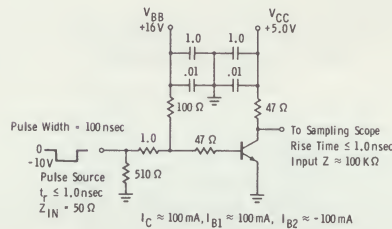
SWITCHING TIMES VERSUS
AMBIENT TEMPERATURE



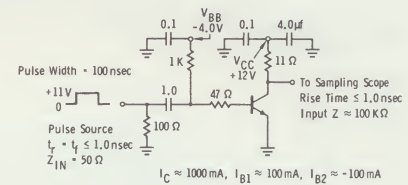
RISE TIME VERSUS COLLECTOR
AND TURN ON BASE CURRENT



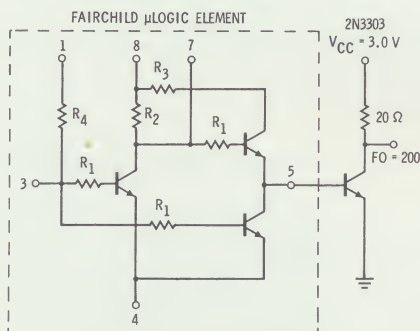
CHARGE STORAGE TIME
MEASUREMENT CIRCUIT



$t_{ON} - t_{OFF}$
MEASUREMENT CIRCUIT

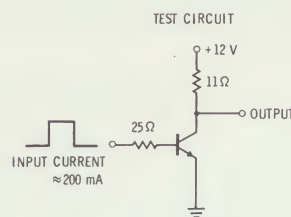


IMPROVING FAN-OUT CAPABILITY

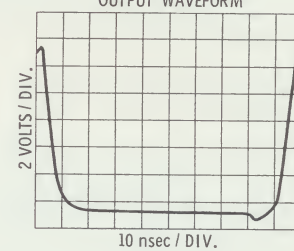


2N3303 USED TO CONVERT BUFFER ELEMENT
(Part #900) FAN OUT FROM 25 TO 200

HIGH SPEED 1 AMPERE PULSE SOURCE



OUTPUT WAVEFORM



FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION